A NEW SPECIES OF *XENOS* FROM ARIZONA, WITH DISCUSSION OF OTHER NORTH AMERICAN SPECIES (STREPSIPTERA: STYLOPIDAE)[1]

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ABSTRACT: *Xenos kifunei*, a new species of Strepsiptera in the family Stylopidae, is described from Arizona. During its developmental stages *Xenos kifunei* is a parasite of *Polistes comanchus navajoe*. This becomes the sixth recognized *Xenos* species from North America, all parasites of *Polistes* species. The status of other North American *Xenos* is discussed.

The genus *Xenos* was described by Rossius (1793) and is distinguished from other genera of Stylopidae by several key characters. *Xenos* males have four antennal segments, the last two are flattened and much longer than the first two, and the first radial wing vein is either continuous, or, if broken, with the apical segment in line with the proximal. All North American species have maxillary palps that are shorter than the mandibles. Female *Xenos* have four, or rarely five, genital openings, compared to five in other Stylopidae. Although not a distinguishing character, *Xenos* species have thus far been found only in hosts from the family Vespidae. Prior to this description, there were 37 recognized species, most parasitic on species of *Polistes*. All North American species are parasites of *Polistes*. Valid North American species include *Xenos peckii* Kirby 1813; *Xenos nigrescens* Brues 1903; *Xenos pallidus* Brues 1903; *Xenos hunteri* (Pierce 1909); and *Xenos rubiginosi* (Pierce 1909).

The North American species of *Xenos* were last reviewed by Bohart (1941). In this revision, Bohart synonymized ten species with either *X. pallidus* or *X. peckii* and recognized only these two species as being valid and distinct. Bohart did not comment on three other named species (*X. nigrescens*, *X. hunteri*, and *X. rubiginosi*), but instead left their status as questionable. Since Bohart's revision, no new North American species of *Xenos* have been described, nor has any taxonomic work been carried out on this group.

All specimens of the new species of *Xenos* described below were recovered from *Polistes comanchus navajoe* Cresson, collected in Arizona, USA. We examined three females and five males and found them to have characters sufficiently different from other species of *Xenos* to warrant this description. Measurements in this description are presented as a range from these specimens.

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Xenos kifunei, Cook and Mathison, NEW SPECIES

(Figures 1 A-C, 2, & 3 A-H)

(all measurements in mm)

Female Description. Cephalothorax dark brown posteriorly. Anterior areas orange-tan (Fig. 1B). First abdominal segment dark brown and tan. Remaining abdominal segments tan with a somewhat darker dorsal region (Fig. 1A). There is some variation in coloration between specimens, some are much darker than others but the pattern of coloration is consistent in all specimens. Total body length 6.38 to 7.40. Greatest body width, measured across the abdomen, 1.90 to 2.13. Cephalothorax length 1.22 to 1.24; its greatest width (behind the first abdominal spiracles) 1.35 to 1.43. Width at first abdominal spiracles 1.24 to 1.32. First abdominal spiracle lateral and somewhat ventral. Distance between mandibles 0.23 to 0.24. Mandibles shaped as in figure 1C.

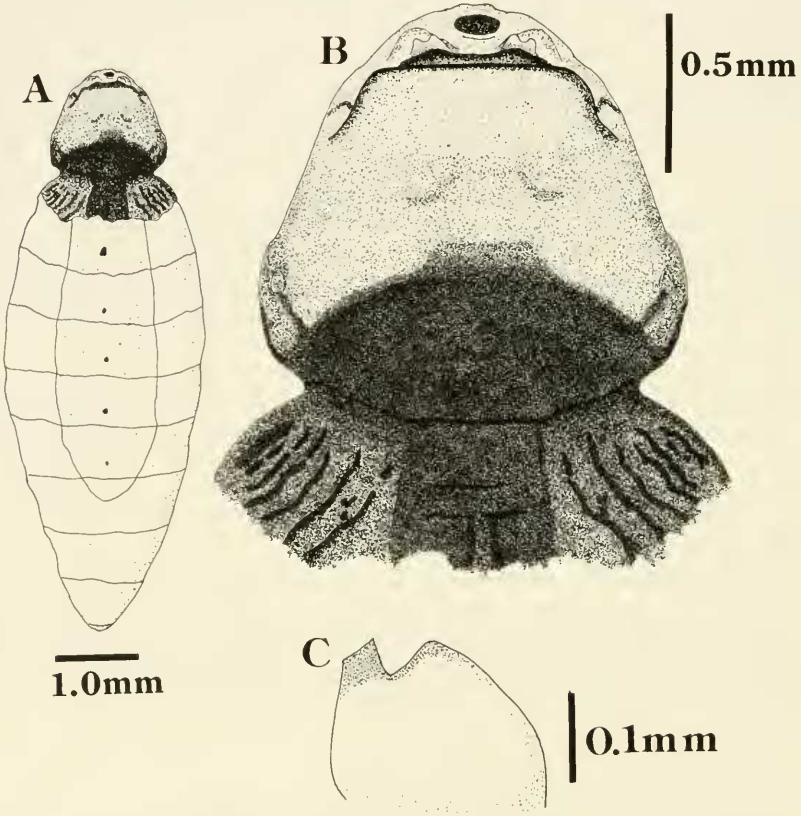

Fig. 1A-C. *Xenos kifunei*, NEW SPECIES, adult female. A. dorsal habitus. B. dorsal cephalothorax and part of first abdominal segment. C. Right mandible.

Abdomen with one genital opening on each of segments II-V, and one specimen has a very small genital opening on abdominal segment VI.

Male description. Body coloration brown, ranging from almost black to light tan or yellow. Total body length 3.14 to 3.53. Head somewhat dumb bell-shaped, with large, dark eyes (Fig. 2). Antennae (Fig. 3A) typical of *Xenos;* third and fourth segments approximately the same size and covered with numerous sensory cups, the latter absent from segments I and II. Antennal segment lengths; I = 0.10, II = 0.06, III = 0.87, and IV = 0.83. Vertex of head pointed, triangular. Mandibles and maxillae shaped as in Fig. 3F. Mandibles crossing in front of mouth, yellow, clear, length 0.26 to 0.30. Maxillae and palps yellow to light brown, combined length 0.21 to 0.25. Legs yellow ventrally, light brown dorsally. Tarsal segment I on prothoracic leg with one large sensory cup on its ventral surface. Femur of metatarsal leg somewhat bowed. Shapes of leg segments as in Fig. 3B, 3C, and 3D. Prothoracic leg measurements; coxa = 0.33 0.34, trochantofemur = 0.40-0.44, tibia = 0.43-0.47, tarsi: I = 0.22-0.23, II = 0.17-0.19, III = 0.11-0.14, IV = 0.15-0.21. Mesothoracic leg measurements; coxa = 0.39. trochantofemur = 0.56-0.58, tibia = 0.48-0.52, tarsi: I = 0.18-0.19, II = 0.12-0.14, III = 0.10, IV = 0.14-0.17. Metathoracic leg measurements; trochanter = 0.21-0.25, femur = 0.52-0.55, tibia = 0.41-0.47, tarsi I = 0.17-0.19, II = 0.1-0.16, III = 0.11-0.14, IV 0.14-0.19. Fore wing club-shaped with one vein (R) to half its length, total wing length 0.33-0.55. Hind wing (Fig. 3E) clear, except for shaded area between Sc

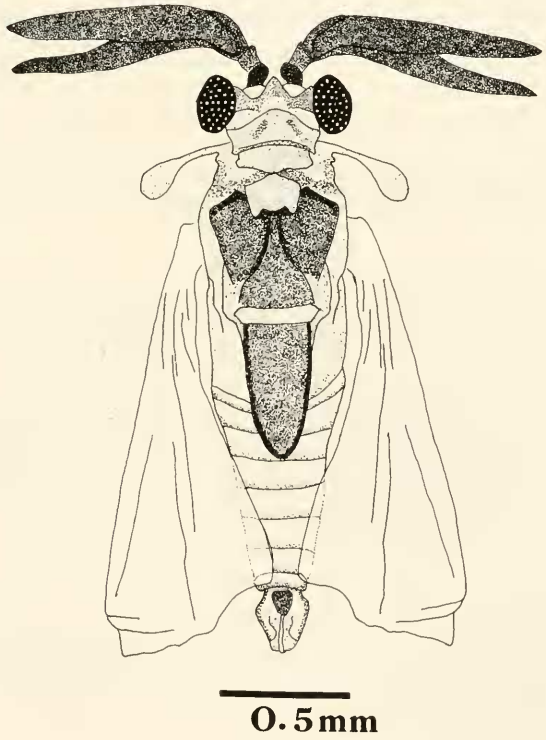

Fig. 2. *Xenos kifunei*, NEW SPECIES, male habitus.

and R veins. Sc vein heavy, reaching half-way to wing margin; R_1 and R_2 divided by gap half as long as R_1; R_1 and R_2 appear to be in line, R_1 is proximal, R_2 is distal; R_2 three times length of R_1; R_3 slightly longer than R_2; R_4 five times as long as R_5; MA = CuA_1 = CuA_2; CuP heavy; no veins reach wing margin. Thoracic segments as in Fig. 2. Abdomen brown, slender. Abdominal segment X dark brown, triangular in dorsal view (Fig. 2). Dorsal abdominal segment IX triangular (Fig. 2), prescutum shape distinctive, shaped as in Fig. 2. Aedeagus (Fig. 3G) clear-yellow, bowed with sharp dorsal projection, no ventral projection or basal hump, thickest in middle of shaft, length 0.25-0.28. One male cephalotheca of puparium was observed (Fig. 3H). Cephalotheca dark brown, total size = 1.23 *X*. 0.56, distance between maxillae = 0.12, distance between mandibles = 0.20, distance between antennae = 0.51.

Triungulin larvae. unknown.

Holotype. Female, in alcohol; Catalina Mountains, Pima County, Arizona; June 11 1965; collected by F. Werner, the host is *Polistes comanchus navajoe* Cresson. Deposited in the United States National Museum.

Allotype. Male, in alcohol, Sycamore Canyon, T 105, R 13, Pima Co., Arizona, June 24, 1961, collected for the Arizona Survey, the host is *Polistes comanchus navajoe*. Deposited in the United States National Museum.

Paratypes. Host of all paratypes is *Polistes comanchus navajoe*. One female, pinned; Molino Canyon in the Catalina Mountains, Pima County, Arizona, October 16, 1994, collected by Blaine Mathison, deposited in the University of Arizona Insect Collection (UAIC). One male, in alcohol, Sycamore Canyon, T 105, R 13, Pima Co., Arizona, June 24, 1961, collected for the Arizona Survey, deposited in UAIC. One male, in alcohol, Catalina Mountains, Pima Co., Arizona, Oct. 7, 1984, collected by Olson, in the collection of the senior author (JLC).

Host voucher. A host, *Polistes comanchus navajoe*, is deposited as a voucher specimen at UAIC.

Etymology. This species is named in honor of Teiji Kifune, for his contribution to the study of Strepsiptera, including the descriptions of several species of *Xenos*.

Diagnosis. *Xenos kifunei* most closely resembles the other five North American species. It is distinct from all *Xenos* in the shape of the prescutum (Fig. 2). It differs from all other North American species in having no basal hump on the shaft of the aedeagus (Fig. 3 G).

Xenos kifunei most closely resembles *Xenos peckii*. Females differ in the pigmentation pattern of the cephalothorax. *Xenos kifunei* has a pigmented area that extends slightly anteriorly in the center (Fig. 1). The pigmented area is strongly emarginate in the middle in *X. peckii*. The teeth of the mandible are of about equal length in *X. kifunei*, but the inner tooth of the mandible of *X. peckii* is much longer than the outer tooth. The cephalothorax of *X. kifunei* is more narrowed anteriorly, giving it a somewhat triangular appearance compared to a round-shaped cephalothorax in *X. peckii*. In male *X. kifunei*, the R5 wing vein is much shorter than R4 while *X. peckii* have R4 and R5 veins almost equal in length. Male mandibles of *X. kifunei* are completely clear yellow but they are black at the base in *X. peckii*.

Xenos kifunei differs from *Xenos pallidus* in several characters. Male *X.*

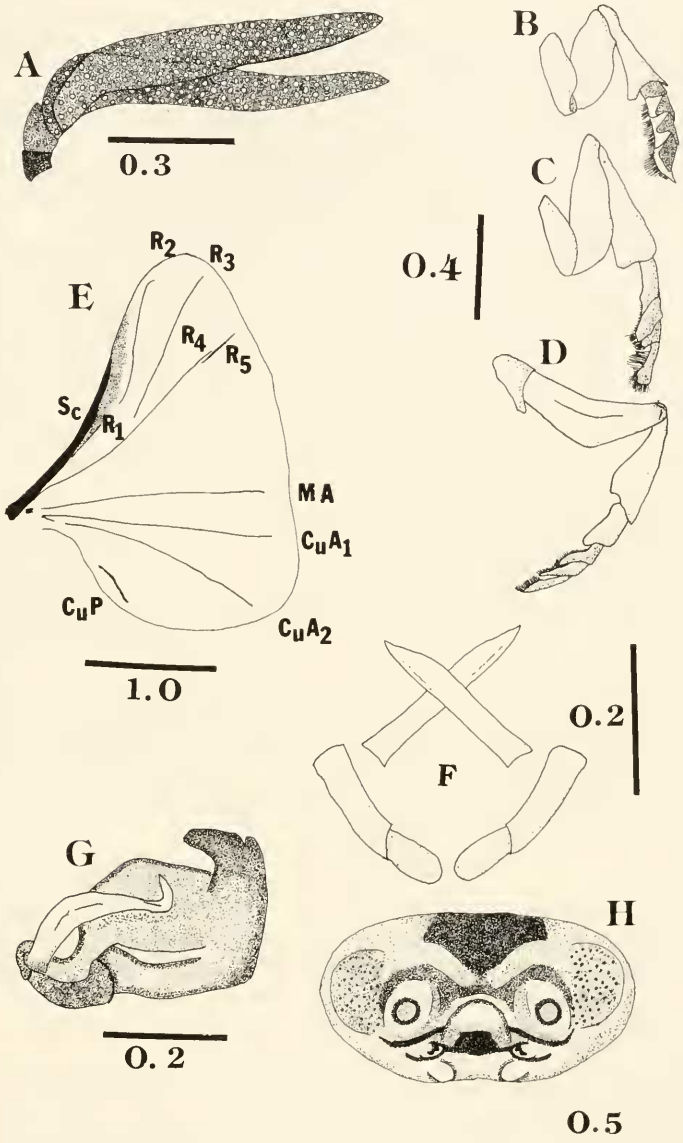

Fig. 3A-M. *Xenos kifunei*, NEW SPECIES, male characters. A. Right antennae. B. Right prothoracic leg. C. Right mesothoracic leg. D. Right metathoracic leg. E. Right hind wing with veins labeled (following designation by Kinzelbach 1972). F. Mandibles, crossing, and maxillae with palps. G. Genital capsule showing aedeagus. H. Cephalotheca of male puparium.

kifunei have a total length of 3.14 to 3.53 mm. compared to 2.25 to 2.75 mm in *X. pallidus*. Lengths of Strepsiptera are quite variable but there is a significant difference between these two species. Hind wing veins are heavy and pigmented in *X. kifunei* but not so in *X. pallidus*. There is a distinct gap in R1 and R2 wing veins in *X. kifunei* but the two appear almost as one vein in *X. pallidus*. *Xenos kifunei* has a CuP vein about equal to R1 in length, while CuP is much shorter (nearly absent) in *X. pallidus*. The females of these species have minor differences, but no easily recognizable characters to separate them.

Xenos kifunei males are significantly smaller than is recorded for *Xenos nigrescens* (3.14 - 3.53 vs. 4.5 mm) and have clear yellow mandibles compared to those of nigrescens, which are black at the base. Wings of *X. kifunei* have heavy, dark wing veins compared to pale veins with posterior veins obsolete in *X. nigrescens*. Females of *X. kifunei* have a pigmented area that covers less than the posterior half of the cephalothorax and mandibles with both teeth nearly equal in length. *Xenos nigrescens* has a pigmented area covering at least 2/3 of the cephalothorax and the inner tooth of the mandible is much larger than the outer.

In males of *X. kifunei* the palps equal the maxillae in width and the mandibles are nearly straight. In *X. hunteri*, the palps are about half as wide as the maxillae and the mandibles are strongly curved. The cephalothorax of female *X. kifunei is* about as wide as long, with less than the posterior half pigmented. The female cephalothorax of *X. hunteri* is longer than wide, with the posterior 3/4 pigmented.

Only the female of *Xenos rubiginosi* is known. *Xenos kifunei* has a cephalothorax about as wide as long, spiracles lateral and somewhat ventral, and pigmentation covering less than the posterior half. The cephalothorax of *X. rubiginosi* is much longer than wide, has dorsal first abdominal spiracles, and pigmentation covering the posterior 2/3 of the cephalothorax.

DISCUSSION

Xenos kifunei becomes the 38th valid species in this genus and the sixth recognized species in North America. The number of North American species in this genus is likely to change, however. The validity of half the recognized species, *Xenos nigrescens, Xenos hunteri,* and *Xenos rubiginosi,* is in question (Bohart 1941). It is also possible that one or more synonymized species may be valid.

The validity of *X. nigrescens* is uncertain and no type specimens were designated by Brues (1903). Brues gave *Polistes rubiginosus* Lepeletier as the host of *X. nigrescens. Polistes rubiginosus* has since been synonymized with *Polistes carolina* (Linnaeus), which is the host of *Xenos peckii.* The character that best distinguishes between *X. nigrescens* and *X. peckii* is the nature of the wing veins. The wing veins of *X. peckii* are very stout and distinctly darkened,

whereas the veins of *X. nigrescens* are weak and barely visible. The female of *X. peckii* has a black pigmented posterior cephalothorax with a strong, square emargination in the center dorsally, while in *X. nigrescens* this pigmented boundary forms a straight line. We have examined three females and one male strepsipteran from *P. carolina* hosts, collected in central Texas, and found them all to closely match the description given by Brues of *X. nigrescens* (type locality, Austin Texas). The specimens we examined were from different locations within the same geographical region as the type locality and we found characters to be consistent among the collections. Our specimens were also collected several years apart. The question remains whether these Texas specimens are a distinct species or a local variation of *X. peckii*. The total number of specimens examined combined with those from Brues' description amounts to five males and four females. Thus, too few are known to make meaningful decisions with such minor differences. However, there is almost no variation in those we have examined.

Xenos hunteri is represented by a female type (USNM cat. no. 10115) and a male description given by Pierce (1909), but has not been reported since. This species was described from an undetermined species of *Polistes*, reported by Pierce to be "near *Polistes minor* Palisot de Beauvois". The type locality was Victoria, Texas. The actual *Polistes* host species that Pierce made this description from is uncertain, but is likely either *Polistes dorsalis dorsalis* (Fabricius) or *Polistes exclamens exclamens* Viereck. The reason for this assumption is that Bequaert (1940) stated that wasps frequently called *P. minor* in the United States are usually *P. fuscatus hunteri* Bequaert (later synonymized with *P. dorsalis dorsalis)* or *P. exclamens*. Both of these species are reported from the type locality of *X. hunteri*. The female type of *X. hunteri* does appear to have characters distinctive from other species of *Xenos*, but with only one specimen available variation is unknown. The male reputedly has characters that differ somewhat from other species of *Xenos*, but reference specimens are unavailable for comparison. There seems to be enough character differences with other *Xenos* to maintain *X. hunteri* as a separate species at this time. Of significant difference are the male mouthparts of *X. hunteri*, whose palp is half as thick as the maxillae, a character found in no other North American *Xenos*.

The status of *X. rubiginosi* is in some doubt. Pierce (1909) listed the host of *X. rubiginosi* as *P. rubiginosus* which has since been synonymized with *P. carolina*, the host of *X. peckii*. However, the description of the shape of the *X. rubiginosi* female cephalothorax appears to be outside the range of *X. peckii*. The uncertainty of species validity occurs because *X. rubiginosi* is known only from the type female (USNM cat. no. 10119). No males have been reported. With both species described from *P. carolina* and only a single specimen of *X. rubiginosi* suggests that this might be an aberrant specimen of either *X. peckii*

or *X. nigrescens*. More specimens from *P. carolina* need to be surveyed to determine the status of *X. rubiginosi*.

Another aspect of *Xenos* taxonomy that is in need of review is the synonyms created by Bohart (1941). In some of the synonymized species, Bohart was forced to make decisions using small numbers of specimens. Some of these synonymies are clearly correct, but for some of the species to be synonyms, there would have to be vast character variation within *X. peckii* and *X. pallidus*. There is, without doubt, some range in the characters of these species. With more specimens collected from reported hosts of the synonymized species such as *Polistes apachus* Saussure and *Polistes metricus* Say, one or more of these synonyms may be reinstated as valid species.

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LITERATURE CITED

Bequaert, J. C. 1940. An introductory study of *Polistes* in the United States and Canada with descriptions of some new North and South American forms (Hymenoptera; Vespidae). J. N. Y. Entomol. Soc., 48(1): 1-30.

Bohart, R M. 1941. A revision of the Strepsiptera with special reference to the species of North America. Univ. Calif. Pub. Entomol., 7(6): 91-160.

Brues, C. R. 1903. A contribution to our knowledge of the Stylopidae. Zool. Jb. (Anat., Ontog.), 18(2): 241-270.

Kinzelbach, R. K. 1971. Morphologische Befunde an Fächerflüglern und ihre phylogenetische Bedeutung (Insecta: Strepsiptera). Zoologica, 41: 1-256.

Pierce, W. D. 1909. A monographic revision of the twisted winged insects comprising the order Strepsiptera Kirby. U. S. Nat. Mus., Bull. 66: 1-232.

Rossius, P. 1793. Observation de M. Rossi sur un noveau genre d'Insecte, voisin des Ichneumons. Bull. Soc. Philomatique, 1: 49.

SOCIETY MEETING OF MARCH 2, 1997

Dr. Owain Edwards
USDA-ARS Beneficial Insects Introduction Research Lab, Newark, Delaware

IS ADAPTATION AFTER RELEASE NECESSARY FOR SUCCESSFUL CLASSICAL BIOLOGICAL CONTROL?

Dr. Edwards began by pointing out that, historically, biological control researchers have assumed that natural enemies must adapt after introduction into novel environments. In fact, lack of adaptation is often presented as the reason for failed establishment. If parasitoid populations from diverse environments differ with respect to fitness traits, this would suggest that adaptation would likely be important after release into a novel environment.

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